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Circular
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Engineering and Design
USE, ACQUISITION, AND SECURITY OF PRECISE POSITIONING
SERVICE GPS RECEIVERS FOR CIVIL APPLICATIONS

1. Purpose. This circular disseminates policy and procedures on the use, acquisition, decryption, and security of tactical Global Positioning System (GPS) receivers for civil applications, such as the Precision Lightweight GPS Receiver (PLGR). Procedures are defined for obtaining these military grade receivers containing secure Precise Positioning Service (PPS) capabilities. This circular effects the transfer of proven military technology to civil users.

2. Applicability. This circular is applicable to USACE commands having civil works, military construction, and environmental restoration responsibilities. Personnel of the U.S. Army Corps of Engineers (USACE) are authorized to use tactical GPS receivers in the conduct of Corps civil and military construction programs.

3. References.

a. Rules for Obtaining Navstar GPS Security Devices, DOD GPS Joint Program Office, Revision A, 12 June 1997.

b. Navstar Global Positioning System Cryptographic Key Ordering Instructions, U.S. Space Command, Revision 3, June 1997.

c. EM 1110-1-1003, NAVSTAR Global Positioning System Surveying, 1 August 1996.

4. Distribution. Approved for public release. Distribution is unlimited.

5. Background. The Navigation Satellite Time and Ranging (NAVSTAR) Global Positioning System is a space-based satellite radio navigation-system developed by the U.S. Department of Defense. GPS receivers provide land, marine, and airborne users with continuous three-dimensional position, velocity, and time data (PVT). This information is available free of charge to an

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unlimited number of users. The system operates under all weather conditions, 24 hours a day, anywhere on Earth. GPS provides two levels of positional accuracy: Standard Positioning Service (SPS) and Precise Positioning Service (PPS). For security reasons, DOD degrades/encrypts the GPS signals, using selective availability (SA) and anti-spoofing (AS) techniques. Any civil user can access the SPS signal with a \$100 to \$500 commercial grade receiver and obtain an accuracy of approximately 100 m (95%). Authorized PPS users can access and decode the encrypted P(Y)-code signal and thus obtain an approximately 10 m positional accuracy unaffected by AS and SA. Access to the PPS signal is controlled through the use of cryptographic techniques, and is limited to U.S. and allied military forces. DOD authorizes PPS access to other government and selected private sector users provided appropriate security requirements and other selection criteria are met. As a DOD component, USACE is authorized access to the tactical PPS signal for its civil works, military construction, or environmental restoration missions. The small, hand-held, PLGR receivers (AN/PSN-11R) can provide real-time, 10-meter absolute positioning or navigation accuracy, and have wide tactical use in military air/land/sea navigation, and related tactical mapping, surveying, and positioning uses. These same receivers can be used to support a variety of USACE civil functions and applications, including GIS development, natural resource management, surveying, land/air/sea navigation, and emergency management.

6. PLGR Project Applications. Stand-alone GPS receivers can compute and display "absolute" geographic positions in real-time throughout most of the world. Absolute GPS positioning is distinguished from differential GPS (DGPS) positioning which requires a simultaneous comparison of positions between two nearby GPS receivers; typically using a communications data link between the two receivers. Accuracies of code-phase DGPS range between 0.5 and 10 m. DGPS carrier-phase differencing techniques can provide relative positional accuracies at the millimeter level. Project functional accuracy requirements and economics will determine whether absolute (either SPS or PPS) or differential GPS techniques are required. PPS accuracies at the 10 meter level will yield sufficient accuracy for many environmental, GIS, and project management applications. PLGR receivers represent an economical navigation and positioning tool compared to traditional surveying or differential GPS methods. In general, PLGR accuracies are suitable for GIS mapping scales of 1:12,000 (1" = 1000 ft) or smaller. PLGR accuracies may also have application in dredge/scow positioning or monitoring,

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environmental mapping, vehicle navigation, and emergency management operations. Where only 100 meter accuracy is required, less-expensive SPS receivers should be used. For accuracies exceeding 10 meters, differential GPS techniques are necessary. All GPS receivers can be operated with minimal training.

a. Current USACE Applications. The use of a PLGR receiver could be applicable whenever the mission requires positioning accuracies that are better than the 100 meters obtained by an SPS receiver, but do not require the specialized equipment needed to acquire differential GPS accuracies. Some of the applications where the use of a PLGR receiver has proven to be effective include emergency management, real estate, OCONUS control surveys, archeological surveys, GIS data collection, wetland delineation, and Corps regulatory activities.

b. Training Options. In order to obtain maximum efficiency from the operation of a GPS receiver, either PPS or SPS, the user must be trained in the operation of the receiver and the receiver interface with ancillary equipment. Training options exist within USACE (U.S. Army Topographic Engineering Center), other government agencies, and the private sector.

7. Acquisition of PPS Receivers. Outlined below are two procurement options available to USACE commands to obtain PPS receivers.

a. PLGR/SOLGR PPS Receivers. USACE users can purchase the PLGR receivers using a Department of Agriculture (USDA) multi-agency contract. The cost in 1998 for a PLGR with a complete complement of accessories (PLGR Kit) is \$2,091.00. Although the USDA contract will expire in 1998, the USDA is currently working toward establishing an amendment to the existing contract or a new contract for delivery of PPS receivers starting in January 1999. The receiver that will probably be delivered in 1999 and beyond will be termed the Special Operations Lightweight GPS Receiver, or SOLGR. This receiver will offer several improvements over the PLGR such as 12 channels, dual frequency operation, waterproof down to 24 meters, programmable function keys.

(1) PLGR/SOLGR Receiver Description. These hand-held PPS receivers are manufactured by Rockwell Incorporated, Collins Avionics Division. The PLGR and SOLGR will determine positions to an accuracy of 16 meters SEP when operating in the PPS mode

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and 100 meters when operating in the SPS mode. Additionally, both instruments contain Wide Area GPS Enhancement (WAGE) for autonomous positioning accuracy to 4 meters CEP and Secure (Y-code) Differential GPS (SDGPS) for positioning accuracy to less than 2 meters CEP. Many vendors interface with the PLGR and SOLGR for GIS applications.

(2) Acquisition Procedures. To procure the PLGR or SOLGR from the USDA contract, first contact the U.S. Army Topographic Engineering Center (USATEC), Geospatial Engineering Branch, ATTN: CETEC-TD-G, 7701 Telegraph Road, Alexandria, VA 22315-3864, telephone (703) 428-6798, e-mail: <pcervari@tec.army.mil>, and request an order form. Complete the form, prepare the paperwork (MIPR, credit card, etc.) to cover cost of required equipment, and fax to USATEC (703-428-6135). USATEC will place the order with the vendor, receive and load the cryptographic keys, check the equipment to insure proper operation, and Fed-Ex the hardware to the ordering office.

b. Non-PLGR/SOLGR PPS Receivers. USACE users can also purchase any other PPS receivers directly from the manufacturer. These receivers can be purchased using standard competitive procurement practices.

(1) Procedure. Approval to purchase a PPS receiver directly from the manufacturer must first be obtained by submitting correspondence to the GPS Joint Program Office (JPO), Headquarters Space and Missile Systems Center, ATTN: CZU, Los Angeles AFB, 2435 Vela Way, El Segundo, CA 90245-5500, defining the project that requires more precise positioning than can be obtained using SPS receivers. The correspondence received from GPS JPO will authorize direct negotiations with the vendor(s).

8. Cryptographic Key Control and Use.

a. General Discussion. PPS requires receivers be loaded with a cryptographic code so that the effects of Selective-Availability (SA) are negated, and to provide for Anti-Spoofing (A-S) capability. To receive the cryptographic keys requires a COMSEC custodian and to load the key into the GPS receiver requires a COMSEC fill device.

b. Acquiring COMSEC Keys. To obtain the cryptographic keys, the COMSEC custodian must process a request for keying material through the Validating Authority for the U.S Army, the Communications Security Logistics Agency (CSLA), ATTN: SELCL-KP-

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KEY, Ft. Huachuca, AZ 85613-7090, who validates the operational need for PPS accuracies and forwards the request to the GPS Controlling Authority. The Deputy Undersecretary of Defense Space (ODUSD/C3I) has designated HQ U.S. Space Command as the Controlling Authority for PPS cryptographic keying material, who, in turn, will notify the appropriate Distribution Center to make distribution to the identified COMSEC Custodian. The actual cryptographic keys are classified CONFIDENTIAL and must be handled accordingly. A keyed receiver is not classified but must be safeguarded like any valuable piece of equipment. If an annual key is not compromised and there are no accidental "zeroizations" of the keyed receiver, the receiver need only be keyed once per key-year.

c. Loading the PPS Receiver. There are several ways the user can have his PPS receiver loaded with the necessary COMSEC key.

(1) District/Division COMSEC Custodian. If the District or Division Office has a COMSEC Custodian, and the COMSEC Custodian has processed and obtained the yearly COMSEC key and the fill devices, each year the PPS receiver will need to be taken to the COMSEC Custodian to have the new key loaded into the receiver. Note: If the receiver is not re-keyed, it will continue to operate, but will operate only as an SPS receiver until re-keyed.

(2) U.S. Army Topographic Engineering Center. Those Districts and Divisions that do not have a COMSEC Custodian may Fed-Ex the receiver(s) overnight to the U.S. Army Topographic Engineering Center, 7701 Telegraph Road, ATTN: CETEC-TD-G, Alexandria, VA 22315-3864. Enclosed with the receiver(s) to be re-keyed should be a completed return Fed-Ex shipping document. CETEC will replace the memory battery, check PPS operation and return the receiver(s).

(3) Other Military Offices. For those USACE commands who do not have a COMSEC Custodian but have a military installation close to their office, the military installation may have a COMSEC Custodian, the COMSEC keys, and the fill devices. The military office may be willing to re-key the PPS receivers. The USACE command should contact the military installation to determine if this approach is feasible.

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9. Proponency and Technical Support. The HQUSACE proponent for this circular is Engineering Division, Directorate of Civil Works, ATTN: CECW-EP. Technical assistance on security requirements or the acquisition of PPS receivers may be obtained from the Geospatial Engineering Branch, U.S. Army Topographic Engineering Center, ATTN: CETEC-TD-G, 7701 Telegraph Road, Alexandria, VA 22315-3864, (703) 428-6798, e-mail: <pcervari@tec.army.mil>.

FOR THE COMMANDER:

A handwritten signature in black ink, appearing to read "RW Burkhardt", with a long horizontal stroke extending to the right.

1 Appendix
APP A - Additional
Information on GPS

ROBERT W. BURKHARDT
Colonel, Corps of Engineers
Executive Director of Civil Works